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## **FIFA Women's World Cup 2011: Pre-Competition Medical Assessment of female referees and assistant referees**

Keller, Dagmar I ; Bizzini, Mario ; Feddermann, Nina ; Junge, Astrid ; Dvorak, Jiri

**Abstract:** **BACKGROUND:** Precompetition screening was implemented for male referees during the 2010 Fédération Internationale de Football Association (FIFA) World Cup. In contrast, female football referees have been neglected in this respect although they experience similar physical work loads compared to male referees. **METHODS:** The standardised football-specific Pre-Competition Medical Assessment (PCMA) was performed in 51 referees and assistant referees selected for the 2011 FIFA Women's World Cup. **RESULTS:** Family history for sudden cardiac death (SCD) was positive in four referees (7.8%), but cardiac examinations did not reveal any pathological findings. Training-unrelated ECG changes were identified in three referees (5.9%), all without correlates in echocardiography or clinical examination. Most common echocardiography findings (66.6%, n=34) were asymptomatic tricuspid and mitral regurgitations. **CONCLUSIONS:** During the present screening, no elite female referee was identified being at risk for SCD, and no referee had to be excluded from participating in the 2011 FIFA Women's World Cup.

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# FIFA Women's World Cup 2011: Pre-Competition Medical Assessment of female referees and assistant referees

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## ABSTRACT

**Background** Precompetition screening was implemented for male referees during the 2010 Fédération Internationale de Football Association (FIFA) World Cup. In contrast, female football referees have been neglected in this respect although they experience similar physical work loads compared to male referees.

**Methods** The standardised football-specific Pre-Competition Medical Assessment (PCMA) was performed in 51 referees and assistant referees selected for the 2011 FIFA Women's World Cup.

**Results** Family history for sudden cardiac death (SCD) was positive in four referees (7.8%), but cardiac examinations did not reveal any pathological findings. Training-unrelated ECG changes were identified in three referees (5.9%), all without correlates in echocardiography or clinical examination. Most common echocardiography findings (66.6%, n=34) were asymptomatic tricuspid and mitral regurgitations.

**Conclusions** During the present screening, no elite female referee was identified being at risk for SCD, and no referee had to be excluded from participating in the 2011 FIFA Women's World Cup.

## INTRODUCTION

Preparticipation screening programmes to prevent sudden cardiac death (SCD) among young athletes have been accepted based on numerous proposals.<sup>1–3</sup> For elite male football players, the Fédération Internationale de Football Association (FIFA) introduced a standardised football-specific Pre-Competition Medical Assessment (PCMA) starting in the 2006 FIFA World Cup<sup>4</sup> and subsequently introduced it for female players; it is now mandatory in all FIFA competitions.<sup>5</sup> PCMA was implemented for male referees selected for 2010 FIFA World Cup and data were published recently.<sup>6</sup> Concerning female referees no data about PCMA have systematically been assessed, yet. Female referees experience similar physical work loads compared to male referees and therefore are at the same risk for SCD as a normal sport population or male referees. In this study, the cardiovascular findings obtained in the PCMA of female referees and assistant referees selected for the FIFA Women's World Cup 2011 were analysed.

## METHODS

The PCMA protocol includes medical history, general physical examination, 12-lead resting ECG and transthoracic echocardiography. The standardised PCMA's were performed at the FIFA headquarter in Frankfurt from 17 to 19 June 2011. All

subjects gave written informed consent. Experienced physicians including a cardiologist (DIK) conducted all examinations. ECG's were analysed according to current recommendations of the European Society of Cardiology (ESC). Findings were grouped into common/training-related and uncommon/training-unrelated.<sup>7</sup> Transthoracic echocardiographies were performed and interpreted based on current recommendations.<sup>8</sup> Data were acquired for each referee on the 'Pre-Competition Medical Assessment—Individual Report' sheet, provided by F-MARC, Medical Research Office, Schulthess Clinic, Zuerich, Switzerland. Mean values and SDs were determined on the Microsoft Excel programme.

## RESULTS

Nineteen female referees and 32 assistant referees underwent precompetition screening. Baseline characteristics were of an average age of 33.2 (SD=3.8, range 25–41) years, average height of 166 (SD=5.4, range 150–181) cm, average weight of 60.1 (SD=5.5, range 48–73) kg and average body surface area of 1.7 (SD=0.1, range 1.45–1.93) m<sup>2</sup>.

In family history, 19 (37%) referees reported hypertension, 11 (21.5%) diabetes mellitus, nine (17.6%) coronary heart disease (CHD), five (9.8%) stroke and two (3.9%) valvular heart disease. Three (5.9%) referees reported familial SCD, another one (2%) reported SCD due to CHD. In general medical history one (2%) referee reported diabetes mellitus type I and another (2%) a suprarenal hyperplasia. Allergies to pollen, food or antibiotics were common (n=17; 33.3%), three (5.9%) referees had exercise-induced asthma. No cardiovascular medication was reported but insulin. Non-steroidal painkillers were used regularly by 23 (45%) referees and 11 (21.5%) took antihistaminics.

Right arm systolic blood pressure was on an average 107.1 (SD=9.9, range 90–131) mm Hg, diastolic 67.3 (SD=10.2, range 48–95) mm Hg. Left arm systolic blood pressure was on an average 105.5 (SD=10.1, range 84–141) mm Hg, diastolic 67.2 (SD=9.2, range 49–95) mm Hg. The average heart rate at rest was 59.8 (SD=9.9, range 47–91) bpm.

Auscultation revealed in 16 (31%) referees a systolic heart murmur without echocardiography finding, though considered as 'functional'. A mild systolic murmur was found in one referee (2%) with mild central aortic regurgitation with a tricuspid aortic valve with slight asymmetry of the cusps, in one (2%) with mild-to-moderate mitral regurgitation due to discrete myxoid changes without



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## Short reports

**Table 1** Number and percentages of referees with echocardiographic findings

Transthoracic echocardiography	Referees (number/percentage)
Tricuspid regurgitation	25/49
Mitral regurgitation	9/17.6
Aortic regurgitation	1/2
Ventricular septum defect	2/3.9

mitral valve prolaps and in one (2%) with a small ventricular septum defect (VSD). In one referee (2%) with a very mild systolic murmur, a very small VSD was detected.

Echocardiography findings are summarised in table 1. No referee revealed a hypertrophic left ventricle (LV) or cardiomyopathy. Average LV values were: interventricular septum diastolic (IVSd) 7.9 (SD=1, range 6–10) mm, posterior wall diastolic (PWd) 8.3 (SD=1, range 6–10) mm, LV muscle mass index 71.5 (SD=11.5, range 48–95) g/m<sup>2</sup> and LV enddiastolic diameter index (LVEDI) 51.5 (SD=9.1, range 35–73) mm/m<sup>2</sup>. LV ejection fraction was on average 67.6 (SD=4.2, range 60–74) %. All had normal diastolic function (E/A 1.8, SD=0.3, range 3.1–1.2).

Findings of the 12-lead resting ECG are shown in table 2. Three (5.9%) referees revealed training-unrelated changes, which were T-wave inversions in all cases.

## DISCUSSION

This study presents the first data of precompetition screening of female football referees selected for the 2011 FIFA Women's World Cup. No elite female referee was identified being at risk for SCD and had to be excluded from participation.

The four (7.8%) referees with a positive family history of SCD revealed no abnormal findings in clinical examination. In contrast, no history of SCD was obvious in the male referees PCMA.<sup>6</sup> This difference might be explained by lacking information about the family history in some subjects on the one hand and lacking data about the correct cause of death on the other hand. One (1.9%) referee with diabetes mellitus type I had a positive family history for diabetes which is inline with the male referee assessment.<sup>6</sup>

In personal history allergies were most frequently found (n=17, 33.3%), three (5.9%) had exercise-induced asthma (EIA). The incidence of EIA is supposed to be higher in football players compared to water sports athletes and lower compared to runners.<sup>9</sup> Two (3.9%) referees had isolated increased diastolic blood pressure (94–95 mm Hg) of which one took regular non-steroidal painkillers which might have a negative effect on blood pressure.<sup>10</sup> Both were advised to follow-up blood pressure measurement.

Systolic heart murmurs were the most common cardiac finding whereas echocardiography revealed in 34 (n=66.6%) referees a tricuspid or mitral regurgitation. In comparison with male referees no LV hypertrophy or cardiomyopathies were identified.<sup>6</sup> A hypermobile atrial septum was found in four (7.8%), an atrial septum aneurysm in two (3.9%) and small VSD in two (3.9%) whereas none of these findings were found in the male referees.<sup>6</sup> Uncommon T-wave inversion was identified in three (5.9%) referees (table 2), of which all had a negative family history for SCD. The incidence was higher compared to male referees with a 3.3% incidence of T-wave inversion in inferior leads.<sup>6</sup> One (1.9%) referee revealed isolated T-wave

**Table 2** Number and percentages of referees with ECG findings

12-Lead resting ECG	Referees (number/percentage)
Training-related ECG changes and common	
Sinus bradycardia	28/54.9
First-degree AV-block	2/3.9
Notched QRS in V1 or incomplete RBBB	7/13.7
Early repolarisation	2/3.9
Isolated QRS voltage criteria for LV hypertrophy	1/2
Training-unrelated ECG changes and uncommon	
T-wave inversion	
Isolated in V2	1/2
Isolated in lead aVL	1/2
In lead III and aVL	1/2

AV, atrioventricular; LV, left ventricular; RBBB, right bundle branch block.

inversion in aVL; echocardiography showed mild-to-moderate mitral regurgitation due to discrete myxoid changes, and normal LV parameters. She was advised for yearly follow-up echocardiography which will be performed in her home country. One (1.9%) referee showed isolated T-wave inversion in V2 without Brugada-like pattern; in contrast male referees revealed a higher incidence of Brugada-like pattern (4.4%; n=7). In the age group of 35 years or more in which SCD is most commonly associated to CHD, all referees were completely asymptomatic and revealed no uncommon findings in 12-lead resting ECG or echocardiography except for one (1.9%) referee with isolated T-wave inversion in lead III. No exercise ECG was performed in the present study.

In this study the standardised PCMA's have been performed shortly before the 2011 FIFA Women's World Cup. Precompetition and preparticipation screening should be performed in every referee or athlete in general. Some of the referees did already profit from previous screening in their home countries, which contributes to this selection of 'healthy' referees.

## CONCLUSIONS

PCMA is a feasible tool to identify referees at risk for SCD and has to be repeated on a regular base. No elite female referee was identified being at risk for SCD and had to be excluded from participating in the 2011 FIFA Women's World Cup.

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**Contributors** DIK performed cardiac examination, data analysis and manuscript writing. MB and NF: performed clinical examination. AJ and JD instrumented the study design, provided support and feedback at all stages of the study and heavily contributed to writing and reviewing the manuscript. All coauthors reviewed and improved the study.

**Competing interests** None.

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## FIFA Women's World Cup 2011: Pre-Competition Medical Assessment of female referees and assistant referees

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